



# Chapter 3: Crew Efficiency Factors



### **Overview**

#### Introduction

#### NOTE &

Specific treatment procedures for the conditions described in this chapter, are covered in Chapter 6 - First Aid chapter of this manual.

This chapter specifies the physical fitness standards that all crew members are required to meet. It also describes some of the hazards and unique discomforts boat crews cope with when operating boats in the marine environment. The combination of many factors such as extreme hot or cold weather, fatigue, and seasickness are all factors that can impair crew performance. Understanding these factors will help crew members remain at the highest level of efficiency while underway.

#### In this chapter

This chapter is divided into eight sections:

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### Coast Guard Boat Crew Seamanship Manual





# Section A. Physical Fitness Standards

#### A.1. General

NOTE &

Auxiliary Physical Standards are found in COMDTINST M16798.3 (series) for being a crew member on an Auxiliary facility. All Coast Guard crew members are required to meet the following standards of physical fitness. Physical fitness standards are required to ensure crew members have sufficient strength, flexibility, and endurance to safely perform duties during normal and adverse conditions. Knowing these standards will ensure that personnel are able to accurately guage their level of fitness and make improvements where necessary.

# A.2. Arm and shoulder strength

The requirements to meet for arm and shoulder strength are to perform as many correct push-ups as possible in one minute. Refer to Figure 3-1 for the required fitness standards.

		FITN	ESS STANDARDS	}	
Males	<b>Push-ups</b>	Sit-ups	Sit and Reach	1.5 Mile Run	12 Minute Swim*
under 30	29	38	16.5"	12:51	500 yds.
30 to 39	24	35	15.5"	13:36	450 yds.
40 to 49	18	29	14.25"	14:29	400 yds.
50 to 59	15	25	12.5"	15:26	350 yds.
60+	13	22	11.5"	16:43	300 yds.
Females	Push-ups	Sit-ups	Sit and Reach	1.5 Mile Run	12 Minute Swim*
under 30	23	32	19.25"	15:26	400 yds.
30 to 39	19	25	18.25"	15:57	350 yds.
40 to 49	13	20	17.25"	16:58	300 yds.
50 to 59	11	16	16.25"	17:55	250 yds.
60+	9	15	16.25"	18:44	200 yds.

\*Note: 12 minute swim test chart is based on Dr. Kenneth Coopers research.

Physical Fitness Standards Figure 3-1



# A.2.a. One minute push-ups

Perform as many correct push-ups as possible in one minute.

Step	Procedure
1	Start with hands shoulder-width apart.
2	Males will be on hands and toes only, females will place knees on the deck and position hands slightly forward of shoulders.
3	In the up position, the elbows must be fully extended.
4	For a proper push-up to be completed, lower the body until the chest is within one fist distance of the deck, and then return to the up position.  The back must be kept straight the entire time.

# NOTE &

# A.2.b. Fitness standards

Age	Push-ups
Males	
under 30	29
30 to 39	24
40 to 49	18
50 to 59	15
60+	13
Females	
under 30	23
30 to 39	19
40 to 49	13
50 to 59	11
60+	9



# A.3. Abdominal and trunk strength

The requirements to meet for abdominal and trunk strength are to perform as many correct sit-ups as possible in one minute. Refer to Figure 3-1 for the required fitness standards.

# A.3.a. One minute sit-ups

Perform as many correct sit-ups as possible in one minute.

<b>NOTE</b>	6L
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Feet may be anchored.

NOTE &

Any resting should be done in the up position.

Step	Procedure
1	Lie on back, bend knees, place heels flat on the floor about 18 inches away from buttocks, and keep fingers loosely on side of the head. Hands may not come off of side of head for sit-up to count.
2	In the up position, elbows will touch the knees, then return so that both shoulder blades are touching the deck.
3	The buttocks should never leave the deck.

# A.3.b. Fitness Standards

Age	Sit-ups
Males	
under 30	38
30 to 39	35
40 to 49	29
50 to 59	25
60+	22
Females	
under 30	32
30 to 39	25
40 to 49	20
50 to 59	16
60+	15



### A.4. Flexibility

To meet the flexibility standard you must be able to reach to at least a specified measurement sitting with feet against a box that has a yardstick on top of the box with the 15-inch mark even with the edge of the box. Refer to Figure 3-1 for the required fitness standards.

A.4.a. Sit and reach

Place a yardstick on top of a box with the 15-inch mark even with the edge of the box.

NOTE &

Step	Procedure
1	Warm up and stretch sufficiently.
2	Remove shoes and sit with feet flat against the box.
	The 15-inch mark is between the individual's feet with the end of the yardstick, 0 inches through 15 inches, extending forward towards the subject's knees.
3	Feet must be no more than eight (8) inches apart.
4	Place the hands exactly together, one on top of the other, with the fingers extended.
5	Keep the knees extended and the hands together.
6	Lean forward without lunging and reach as far down the yardstick as possible.
7	Record the reach to the nearest ½ inch.
8	Three trials are allowed to pass the minimum standard.

# A.4.b. Fitness standards

Age	Sit and Reach
Males	
under 30	16.5"
30 to 39	15.5"
40 to 49	14.25"
50 to 59	12.5"
60+	11.5"



Females	
under 30	19.25"
30 to 39	18.25"
40 to 49	17.25"
50 to 59	16.25"
60+	16.25"

#### A.5. Endurance

The requirement to meet the endurance standard is to run/walk 1.5 miles in, or perform a 12-minute swim. Refer to Figure 3-1 for the required fitness standards.

# A.5.a. 1.5 mile run/walk

For the endurance qualification, an individual will be required to run/walk 1.5 miles, or perform a 12-minute swim within the indicated time.

Step	Procedure
1	Refrain from smoking or eating for two (2) hours prior to this test.
2	Warm up and stretch sufficiently.
3	Run or walk 1.5 miles in the required amount of time for the appropriate age bracket.
4	If possible, receive pacing assistance, either by having a trained pacer run alongside or by calling out lap times during the test.
5	Be forewarned not to start out too fast and not to run to complete exhaustion during the test.
6	At the end of the test, walk for an additional five (5) minutes to aid in recovery.



# A.5.b. 12-minute swim

The 12-minute swim is an alternative method to fulfill the endurance qualification.

Step	Procedure
1	Warm up and stretch sufficiently.
2	Swim the required distance for the appropriate age bracket in 12 minutes.
3	Use whichever stroke desired and rest as necessary.

# A.5.c. Fitness standards

Age	1.5 mile run/walk	12 Minute Swim
Males		
under 30	12:51	500 yds.
30 to 39	13:36	450 yds.
40 to 49	14:29	400 yds.
50 to 59	15:26	350 yds.
60+	16:43	300 yds.
Females		
under 30	15:26	400 yds.
30 to 39	15:57	350 yds.
40 to 49	16:58	300 yds.
50 to 59	17:55	250 yds.
60+	18:44	200 yds.

# A.6. Annual assessment

Annual assessment should be performed by unit Wellness Representative (WR), unit Fitness Leader (FL), or independent support command Wellness Coordinator (WC) who have been trained to perform the same fitness assessments. These personnel not only perform the annual test, but also create unit or individual fitness routines to maintain or increase physical fitness.



# Section B. Crew Fatigue

#### **B.1.** General

The crew's physiological well-being plays an important role in the safe and successful accomplishment of each Coast Guard mission. As a boat crew member you will assist people during the worst conditions. At times you may feel like you have reached the limits of your physical and mental endurance.

#### **B.2.** Fatigue

Mental and physical fatigue are among the greatest dangers during rough weather operations. The hazards of fatigue dramatically reduces the powers of observation, concentration, and judgment. This reduces the ability to exert the effort necessary, and increases the probability that chances will be taken and prescribed safety precautions to be disregarded. The following are examples of situations that may cause fatigue:

- Operating in extreme hot or cold weather conditions
- Eye strain from hours of looking through sea-spray blurred windshields
- The effort of holding on and maintaining balance
- Stress
- Exposure to noise
- Exposure to the sun
- Poor physical conditioning
- · Lack of sleep
- Boredom

At times like these, do not be tempted to take chances, such as towing too fast or crossing a bar under dangerous conditions. Always keep the safety of the crew and other passengers as the foremost concern.



# **B.3.** Crew responsibility

The crew's safety and welfare are the coxswain's primary responsibility. Coxswains must be constantly aware of stress signs evident in their crews, learn to recognize fatigue, and take corrective action. Crew members must watch each other's condition to prevent excessive fatigue from taking its toll. Note the ability of each member to respond to normal conversation and to complete routine tasks.

#### **B.4. Symptoms**

The primary symptoms of fatigue are:

- Inability to focus or concentrate/ narrowed attention span
- Mental confusion or judgment error
- Decreased coordination of motor skills and sensory ability (hearing, seeing)
- Increased irritability
- Decreased performance
- Decreased concern for safety

Any one of these symptoms can cause mistakes in judgment or cause you to take shortcuts that could threaten the safety of the mission and crew. It is important to ward off the effects of fatigue before it gets too great. Fatigue can lead to faulty decisions and a "don't care" type of attitude.

#### **B.5. Prevention**

Coxswains must be aware of the dangers that exist when crew members push themselves beyond reasonable limits of performance. They should help eliminate mistakes caused by fatigue. Coxswains must not hesitate to call for assistance when fatigue begins to impair the efficiency of their crew.

Some preventive measures are:

- Adequate crew rest
- Dress appropriate for weather
- Rotate crew duties
- Provide food and refreshments suitable for conditions
- Observe other crew members for signs of fatigue



B.5.a. Environmental conditions

### NOTE &

Information on Boat Crew Fatigue Standards may be found in COMDTINST 16130.2 (series), CG Addendum to National SAR Manual. Despite the normal operating climate in a particular area, all crew members must dress (or have clothing available) for unexpected weather. Keeping warm in cold weather and cool in hot weather helps prevent fatigue. Some other environmental conditions that also promote fatigue are:

- Motion sickness
- Glare from the sun
- Wind and rough sea conditions
- Rain or snow
- Vibration (boat engine)

### Chapter 3: Crew Efficiency Factors





### Section C. Motion Sickness

# C.1. Causes of motion sickness

Motion sickness (seasickness) occurs when there is an imbalance between visual images and the portion of the middle ear which senses motion. Mental and physical stress, as well as the rolling or pitching motion of a boat, contribute to motion sickness. Reading chart work, or other tasks that require close attention, will aggravate motion sickness.

#### C.2. Symptoms

The motion of the boat, especially when the boat's heading produces a wallowing or rolling motion, can cause the typical symptoms of nausea and vomiting. The primary symptoms of seasickness are:

- Nausea and vomiting
- Increased salivation
- Unusual paleness
- Sweating
- Drowsiness
- Overall weakness
- Stomach discomfort

# C.3. Prevention / medication

#### **CAUTION!**

Some antimotion medications may cause drowsiness. Consult a medical professional to determine if other alternatives are available.

Motion sickness can often be prevented or made less severe with different kinds of antimotion medication, including the use of Scopolamine patches. Crew members who are especially susceptible to motion discomfort should take medication when weather and sea conditions are such that motion sickness is likely to occur.

#### NOTE &

Crew members susceptible to motion discomfort should take antimotion medication throughout their watch since they never know when they will be dispatched on a mission. This medication taken just before getting underway may not have its maximum effect during the mission.



Besides taking medication, there are other things that can be done to help prevent seasickness.

- Stay out of confined spaces
- Stay above deck in the fresh air
- Avoid concentrating on the movement of the boat by looking out over the water toward the horizon or shoreline
- Avoid smoking

#### C.4. Restrictions

### **CAUTION!**

Do not take antimotion medication if any of these restrictions apply to you. COMDTINST M6710.15 (series), Antimotion Sickness Medications, restricts medication use. Specifically, it must not be given under the following circumstances:

- Without medical supervision
- Within 12 hours of alcohol consumption
- To pregnant crew members



### Section D. Lethal Fumes

# **CO Poisoning**

#### **D.1.** Introduction

Every year, people are at risk of injury or death from exposure to lethal fumes. Carbon monoxide (CO) is a colorless and odorless gas. It is the most common lethal gas encountered during boat operations.

### **D.2.** Conditions where CO may be present

The following conditions are associated with CO poisoning:

- Fuel-burning devices
- **Enclosed** areas
- Underway
- Fires

#### D.2.a. Fuel-burning devices

Operating any fuel-burning devices such as gasoline or diesel engines, CG-P1 and CG-P5 pumps, propane or alcohol stoves, acetylene torches and kerosene heaters, produces CO fumes.

#### D.2.b. Enclosed areas

Personnel can be quickly affected by CO fumes in areas such as closed cockpits or unventilated spaces below decks.



If you find yourself in a compartment which may be affected by lethal fumes, breathable air may be found near the deck. Crouch or crawl on the deck to reach an exit.

- Sleeping in a closed cabin while using certain types of catalytic and/or flame producing heaters.
- Working alone in an engine compartment with the engines operating.
- A defective exhaust system can allow fumes to accumulate in a confined space on board a vessel.



#### D.2.c. Underway

The boat does not need to be stationary for a problem with CO fumes to occur. For example, a following wind can circulate exhaust gases throughout the cockpit of a slow-moving boat.

The construction of some cockpits or cabins can cause the eddies from a wind current to draw fumes back aboard.

#### D.2.d. Fires

Breathing the by-products of a fire is another source of dangerous fumes. Even a recently extinguished fire is still dangerous. Fires can also create other highly lethal fumes such as cyanide gases. This happens when different types of plastics, upholstery, cushions, or electronics insulation burn.

#### **D.3. Symptoms**

Symptoms of lethal fume poisoning can include one or more of the following:

- Throbbing temples
- Dizziness
- Ears ringing
- Watering and itching eyes
- Headache
- Cherry pink skin color

#### **D.4.** Prevention

- Always ensure adequate circulation of fresh air throughout the vessel.
- Try to minimize the effect of exhaust fumes on the vessel. This may
  be as simple as making a minor course change or increasing speed, or
  open a window or crack open a door, etc.

# D.5. Response to victims

The first senses affected by poison gases are those that control a person's judgment and decision-making ability. Once a person is affected by dangerous fumes, they may not be able to help themselves.

If carbon monoxide or any other type of poisoning is suspected, get the victim to fresh air and get medical help immediately.



### Section E. Noise

# E.1. Noise as a fatigue factor

Any continual noise at the same pitch can distract, lull, or aggravate to the point where it adversely affects temperament and the ability to perform properly. Moreover, loud noise can cause hearing loss and contribute to excessive fatigue. Coxswains should be aware of the effect noise may be having on the crew.

# E.1.a. Noise management

These are a few measures to help manage noise:

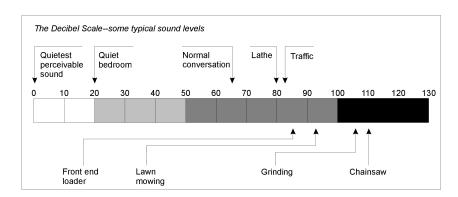
# NOTE &

Make minor changes to engine speed

Ear protection is required when working in, or making rounds in, an enclosed engineering space.

- Adjust radio controls so they produce a minimum amount of static
- Use ear protection whenever noise levels exceed 85 decibels (See Figure 3-2 for decibel scale.)

Guidelines for preserving hearing are contained in COMDTINST M5100.47 (series), Safety and Environmental Health Manual and COMDTINST M6000.1 (series), Medical Manual.



Decibel Scale Figure 3-2

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# Section F. Drugs and Alcohol

#### F.1. General

Alcohol and drug use cause slower reaction time, lack of coordination, slurred speech, drowsiness, or an overconfident attitude. Hangovers also cause irritability, drowsiness, sea sickness, and a lack of concentration. Crew members who knowingly get underway for a Coast Guard mission while under the influence are violating Coast Guard policy and put themselves and others at risk.

# F.2. Prescription drugs

Prescription drugs have the ability to adversely affect or incapacitate crew members. Certain medications can be as incapacitating as alcohol. In addition, many medications, if taken with alcohol, accentuate the action of both. Always notify the command if you are taking prescription drugs which may affect your performance or prevent you from performing your duties.

#### F.3. Alcohol

Alcohol is a well recognized central nervous system depressant. It is one of the most frequently used and abused drugs in our society. Even small amounts of alcohol in the blood can seriously impair judgment, reflexes, muscular control and also reduce the restorative effects of sleep. The level of alcohol in the body varies with the frequency and amount of alcohol intake, the length of time following cessation of drinking and an individual's body weight A zero alcohol level is essential for boat crew personnel to meet the rigorous demands of boat operations. Detectable blood alcohol or symptomatic hangover are causes for restricting of boat crew personnel from operations. Although some personnel may completely metabolize all alcohol well within eight or twelve hours, this time span allows an adequate margin of safety before resuming operations.

#### F.4. Tobacco

The nicotine contained in tobacco is a quick-acting poison. Excessive smoking causes depression of the nervous system and impairment of vision. The carbon monoxide resulting from the combustion of tobacco is absorbed by the bloodstream in preference to oxygen, resulting in a lowering of altitude tolerance. Tobacco smoke also irritates the respiratory system.



#### F.5. Caffeine

The drug caffeine, contained in coffee, tea and many soft drinks, can produce an adverse effect on the body. The amount of caffeine contained in just two cups of coffee appreciably affects the rates of blood flow and respiration. In small amounts, coffee can be considered a nervous system stimulant. Excessive amounts may produce nervousness, inability to concentrate, headaches, and dizziness. Individuals accustomed to daily intake of caffeine may develop headaches and experience a loss of sharpness if daily intake is stopped or significantly curtailed. Caffeine withdrawal syndrome may impact flight safety.



### Section G. Cold Related Factors

### **Overview**

#### Introduction

The purpose of this section is to briefly describe the precautions to take while operating in cold weather. Cold rain, snow, ice storms, and high winds can develop with very little warning in certain parts of the country. Preparation before encountering these kind of conditions and understanding the effects of cold on personnel safety is vital.

#### In this section

#### This section has this information:

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Frostbite	3-25
Layering Clothing	3-26



### **Effects of Cold Weather**

#### G.1. General

Operating in a cold climate presents the challenge of keeping warm enough to tolerate the weather and yet effective enough to carry out the mission. As the temperature drops or you become wet and tired, more insulation is required to keep the body from losing its heat.

#### WARNING 💖

Excessive loss of body heat, which can occur even in mild weather conditions, may lead to hypothermia.

#### G.2. Wind

Wind affects body temperature. Those parts of the body exposed directly to the wind will lose heat quickly, a condition commonly referred to as "wind chill." On bare skin, wind will significantly reduce skin temperature, through evaporation, to below the actual air temperature.

#### **WARNING** 💖

Prolonged exposure to the wind may lead to hypothermia and/or frostbite.

#### **G.3.** Crew fatigue

The combination of rough seas, cold temperatures and wet conditions can quickly cause the crew to become less effective. Crew fatigue will occur more quickly when these conditions are present. Many accidents occur when cold induced fatigue sets in because the mind loses attentiveness and physical coordination diminishes. Even a crew which is moderately cold and damp will exhibit a decrease in reaction time which is also a symptom to the onset of hypothermia.



# **Hypothermia**

**G.4. Hypothermia** Hypothermia is the loss of internal body temperature. Normal internal body temperature is 98.6° F (39°C) and is automatically regulated by our bodies to remain very close to this temperature at all times. A minor deviation either up or down interferes with the bodily processes. Being too cold will adversely affect the body. Even a minor loss of internal body temperature may cause incapacitation.

G.4.a. Observable signs

WARNING 💖

Prolonged exposure to the wind may

lead to hypothermia and/or frostbite.

Signs that a person may be suffering from hypothermia include:

- Pale appearance
- Skin cold to the touch
- Pupils are dilated and will not adjust properly when exposed to light
- Poor coordination
- Slurred speech / appears to be intoxicated
- Incoherent thinking
- Unconsciousness
- Muscle rigidity
- Weak pulse
- Very slow and labored breathing
- Irregular heart beat

Expect a hypothermic person to tremble and shiver, however, these symptoms may not always be present. When a person stops shivering, their hypothermia may have advanced beyond the initial stages.

### **WARNING** ♥

Never give hypothermia victims anything by mouth, especially alcohol.

### 3-23



#### G.4.b. Prevention

#### NOTE &

Treatment for hypothermia is covered in Chapter 6, First Aid. Cold and hypothermia affect crew safety and mission performance, and prevention must be a top priority. Coast Guard policy calls for hypothermia protective clothing to be worn when the water temperature is below 60°F (15.5°C).

The Commanding Officer or Officer in Charge may waive the requirement for wearing a hypothermia protective device on a case-by-case basis if the degree of risk to hypothermia is minimal, such as in nonhazardous daylight operations in calm water. However, proper personal protective equipment must be carried onboard.

Antiexposure coveralls are designed to be worn over the uniform in the same manner as standard coveralls. For added protection, wear polypropylene thermal underwear next to the skin to act as a moisture wicking layer.

NOTE &

Units shall carry hypothermia protective devices on board under waiver conditions (except for ship's boats operating within sight of the ship). Coxswains shall make sure crew members don a hypothermia protective device when waiver conditions no longer apply (for example, when they encounter or anticipate heavy weather or hazardous operating conditions).

NOTE &

Auxiliary boat crews must gain approval and direction from their operations commander for waivers.



### **Frostbite**

#### G.5. Frostbite

Frostbite is the development of ice crystals within body tissues. Frostbite is most likely to develop in air temperatures less than 20°F (-6.6°C). These are factors contributing to frostbite development:

- Cold stressors, such as wind, air temperature, or exposure to water
- Any restriction of blood flow
- Lack of appropriate protection
- Skin exposure

#### G.5.a. Symptoms

A frostbite victim will complain of painful cold and numbness in the affected area. Waxy white or yellow white, hard, cold, and insensitive areas will develop. As the area begins to thaw, it will be extremely painful and swelling (reddish-purple) or blisters may appear. Areas prone to frostbite include all extremeties where the blood has traveled farthest from the heart, such as the hands, feet, face, and ear lobes. A patient suffering from frostbite should also be treated for hypothermia.

#### G.5.b. Prevention

#### **CAUTION!**

Any person who has had frostbite previously, is at an increased risk for cold exposure injury in that same area of the body. Cold weather clothing and equipment is essential in preventing cold related injuries and fatigue. Such items include thermal boots, woolen socks, watch caps, gloves, and thermal undergarments (polypropylene) fleece or pile. During cold conditions, coxswains should discuss the possibilities of frostbite with the crew before getting underway.



# **Layering Clothing**

# G.6. First layer - wicking

Staying dry is an essential factor to maintaining body temperature. Clothing worn next to the skin must carry or "wick" moisture away from the body. Cotton clothing pose particular problems. They absorb and retain moisture, which will rob body heat through evaporation. Wool has good insulating properties even when wet, but it is less than ideal because it stays wet. Modern synthetic wicking fibers such as polypropylene, Thermax<sup>tm</sup>, or Capilene<sup>tm</sup>. do not retain moisture. They will actually draw moisture from the skin and transport it to an absorbent outer layer. This gear works well by itself or it can be combined with a second layer for extreme cold.

# G.7. Second layer - insulation

The insulating effect of a fabric is related to how much air it can trap. This is why a loose-knit or fuzzy material is better than one that is tightly knit. It is also why two thin layers of a given material are better than one thick one. The second layer traps air, which retains body heat, while absorbing excess moisture from the first layer. Wool or cotton thermals are an acceptable second layer if worn over a wicking layer, but a number of synthetic fleece or pile garments do a much better job. An example of this is the fleece coverall.

# G.8. Third layer - moisture barrier

#### Note &

Dry suits require a PFD. They have no inherent buoyancy. The outer layer should stop wind and water, so the inner layers can work as designed. Choices include the anti-exposure coverall, dry suit, or "rain gear." The dry suits and rain gear have no insulating properties and will require extra insulation for cold weather. Also, as most dry suits do not "breathe," an absorbent second layer is needed so that perspiration has a place to go.



#### **G.9.** Extremities

#### NOTE &

For additional information on Hypothermia, read COMDTPUB P3131.6 (series), A Pocket Guide to Cold Water Survival.

Most heat loss occurs through the extremities, especially the head. It is particularly important to cover these areas well. It is still important to layer properly, but thinner, or all-in-one materials must be used to reduce bulk. For the head, a wool cap may work, but a heavy wicking hood or cap worn alone or under a wool cap will keep you drier and warmer. A rain hat/hood/sou'wester should be considered for wet weather. Gloves should be waterproof, and a wicking liner glove will work better than wool. High top rubber boots are the only option for wet weather. A wicking liner sock under a wool, cotton, or fleece outer sock will provide the best warmth. Insoles should be non-absorbent. A perforated foam insole also works well.

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### Section H. Sun and Heat Related Factors

### **Overview**

#### Introduction

Crew members must be aware of the dangers of too much exposure to the sun and take preventative measures to guard against a decrease in performance. Performance can easily be affected by the heat and vibration of the boat which can increase fatigue. This section discusses the various sun and heat related factors that crew members may encounter during their activities.

#### In this section

This section contains this information:

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Heat Stroke	3-36
Susceptibility to Heat Problems	3-37



#### **Sun Burns**

#### H.1. General

Continuous exposure to the sun can cause sunburn and other complications such as heat stroke, dehydration, etc. Unprotected exposed skin will suffer from premature aging and an increased chance of skin cancer.

### H.1.a. Symptoms

Sunburn appears as a redness, swelling, or blistering of the skin. Other effects of overexposure to the sun are fever, gastrointestinal symptoms, malaise, and pigment changes in the skin.

#### H.1.b. Prevention

#### NOTE &

For additional information on heat related injuries, refer to *COMDTPUB P6200.12* (*series*), *Preventive Heat Casualties*.

If exposed to the sun for prolonged periods of time, take precautions. Stay in the shade when possible. However, just getting out of direct sunlight is not always enough since sun can be just as harmful when reflected off a bright surface, such as sand or water. Use sun screen lotion with a sun protection factor (SPF) of 15 or higher. Wear protective clothing; a hat with a brim and sunglasses with UV protection for eyes.

#### H.1.c. Treatment

Most sunburns do not appear fully until after being exposed to the sun for several hours. Treatment consists of applying cool wet towels to the affected area. Cooling the skin temperature is very important. Keep the skin moist but be wary of what product is applied. Many lotions contain perfumes, alcohol, or wax which will only aggravate the burn. Several types of first aid sprays give fast but short-lived relief.



### **Dehydration**

# H.2. Fluid loss and hydration

#### **CAUTION!**

Do not use salt tablets unless prescribed by a physician. The use of salt tablets does not improve well-being despite the amount of perspiration or salt/electrolyte loss.

An adequate fluid intake is essential to remain healthy while underway. Fluids are lost from the body in several ways. The most obvious loss is through the kidneys. The less obvious loss of body fluid occurs through perspiration from the skin and respiration through the lungs. As a result, an average, healthy adult requires two or three liters of fluid a day to replace these losses. Extremely warm weather significantly increases the loss of fluids. Try to stay away from liquids such as tea, alcohol, coffee, and soft drinks. These liquids speed up fluid loss.

One vital element of body fluids that must be maintained are Electrolytes. The balance of electrolytes between intake and loss is important and must be maintained. Recent medical studies have identified that normal dietary practices will maintain an adequate electrolyte level.

#### H.2.a. Symptoms

Healthy adults must satisfy their water and electrolyte requirements. When water and electrolytes are not replaced, the body experiences dehydration. Drinking alcohol and caffeine increases dehydration. At first there is thirst and general discomfort, followed by an inclination to slow physical movement, and a loss of appetite. As more water is lost, an individual becomes sleepy and experiences a rise in body temperature. By the time the body loses 5% of body weight in fluids, the individual begins to feel nauseated. When 6 to 10% of body fluids are lost, symptoms increase in this order:

- Dry mouth
- Dizziness
- Headache
- Difficulty in breathing
- Tingling in the arms and legs
- Skin color turns bluish
- Indistinct speech
- Inability to walk
- Cramping legs and stomach



#### H.2.b. Prevention

Drinking fresh clean water is the best and easiest method to replace fluid loss and prevent dehydration. Almost all fluids are suitable including fruit juices, soups, and water. Drinks that do not contain sodium (salt) are recommended. Drink plenty of fluids throughout the day, especially in warm, dry climates.

If you know you will be away from a source of water for a long period of time, bring an ample supply of water with you.

#### H.2.c. Treatment

#### WARNING **%**

Never force fluid by mouth to a person who is unconscious or semiconscious. The signs of dehydration can be subtle. Be particularly watchful of other crew members under extreme conditions of sun and heat. The crew should be encouraged to drink fluids throughout the mission. Rotating crews between sun exposure tasks and shaded tasks will help prevent dehydration. If a crew member becomes dehydrated, remove the person immediately from further exposure to heat and/or sun. Get prompt medical attention. Mild cases will become serious if activity continues in the setting where the illness first occurred.



# **Heat Rash (Prickly Heat)**

#### H.3. General

Heat rash is prevalent among those living and working in warm, humid climates or in hot spaces ashore or aboard boats. It may occur in cool weather if a person overdresses.

### H.3.a. Symptoms

Heat rash is caused by:

- breakdown of the body's ability to perspire, and
- decreased evaporative cooling of the skin.

Heat rash interferes with sleep, resulting in decreased efficiency and increased cumulative fatigue, making the individual susceptible to more serious heat disorders. Heat rash also accelerates the onset of heat stroke. Symptoms are:

- Pink or red minute lesions
- Skin irritation (prickling)
- Frequent, severe itching

#### H.3.b. Prevention

Coxswains and crew members must be aware of negative effects brought on by heat rash, and be alert for symptoms when operating in a hot environment. Rotating crews between heat related tasks and those jobs in a cooler environment will help prevent heat rash from occurring.

#### H.3.c. Treatment

If heat rash occurs, remove a crew member from further exposure to excessive heat immediately. Take positive action to prevent the onset of more serious disorders. Apply cool, wet towels to the affected areas.



### **Heat Cramps**

#### H.4. General

Heat cramps are painful contractions caused by excessive salt and water depletion. Heat cramps may occur as an isolated occurrence with normal body temperature or during heat exhaustion. Recently stressed muscles are prone to heat cramps, particularly those muscles in the extremities and abdomen.

H.4.a. Symptoms

The victims legs will be drawn up and excessive sweating will occur. The victim may grimace and cry out in pain.

H.4.b. Prevention

Follow the guidelines discussed previously for other heat related illnesses.

H.4.c. Treatment

Treat heat cramps by placing the victim in a cool place. Encourage the victim to lie down in a comfortable position. Offer cool drinks to replace fluid loss. Solutions containing electrolytes, like a sports drink, are also useful, however, do not allow the ingestion of excessive salt. Do not treat cramped muscles with heat packs or massage. Get prompt medical assistance for severe or persistent conditions.



# **Heat Exhaustion**

H.5. General	Heat exhaustion is more complex than heat cramps. The cause of heat exhaustion is a loss of too much water through perspiration.
H.5.a. Symptoms	When suffering from heat exhaustion, a person collapses and sweats profusely. The victim has pale skin, a pounding heart, nausea, headache, and acts restless.
H.5.b. Prevention	Follow the guidelines discussed previously for other heat related illnesses.
H.5.c. Treatment	Immediately provide first aid treatment followed by rapid removal (in a litter, if possible) of the patient to a location that can provide proper medical care.



### **Heat Stroke**

#### H.6. General

Heat stroke is a major medical emergency and results from the complete breakdown of the body's sweating and heat regulatory mechanisms. Heat stroke or "sun stroke" is caused by operating in bright sun or working in a hot environment, such as an engine compartment. The onset of heat stroke is very rapid.

#### H.6.a. Symptoms

The major symptoms of heat stroke are:

- Skin is red, hot, and dry to the touch (cessation of sweating); characteristic body temperature above 105°F (40.5°C)
- Headache
- Weak and rapid pulse
- Confusion, violence, lack of coordination, delirium, and/or unconsciousness
- Brain damage will occur if immediate medical treatment is not given

#### H.6.b. Prevention

Guard against heat stroke (in most cases) by using the procedures for preventing other heat related illnesses described earlier in this chapter.

#### H.6.c. Treatment

Heat stroke is the most serious of all heat disorders and is an immediate threat to life. No matter which type of operation or assigned mission you are conducting, ALL INCIDENTS OF HEAT STROKE MUST BE CONSIDERED AS MEDICAL EMERGENCIES. There is a high mortality rate associated with heat stroke. Remember, heat exhaustion is the result of overloaded heat balance mechanisms that are still functioning. Heat stroke strikes the victim when the thermo-regulatory mechanisms are not functioning, and the main avenue of heat loss, evaporation of sweat, is blocked. Treat the patient immediately or death may occur.



# **Susceptibility to Heat Problems**

#### H.7. General

Personnel who are not accustomed to strenuous physical activity in hot and humid environments, are particularly susceptible to heat injuries. Excess body weight contributes to this susceptibility.

# H.8. Clothing and equipment

Impermeable clothing does not "breath" and thus greatly increases an individual's susceptibility to heat related illnesses. Clothing acts as a barrier that prevents evaporative cooling. Many synthetic fabrics reduce the absorption and dispersal of sweat needed to achieve optimum heat loss by evaporation.

Clothing and equipment should be worn so that there is free circulation of air between the uniform and the body surface. Wearing shirt collars, shirt cuffs, and trouser bottoms open will aid in ventilation. However, this practice may not be permissible in those areas where loose fitting or open style clothing would present a safety hazard (e.g., around machinery with moving parts).

In full sunlight or a high radiant heat source (e.g., machinery spaces), keeping the body covered with permeable clothing reduces the radiant heat load upon the body. When not working in these areas, removal of the outer layer of clothing will help reduce body temperature. Impermeable clothing must be avoided. When using impermeable clothing, take precautions to avoid the rapid buildup of body heat. Heat illnesses may be manifested in minutes if impermeable clothing is worn.

#### H.9. Fever

Febrile illnesses (fever) increases the chance of rapid heat buildup within the body. The presence of fever before heat stress exposure reduces the allowable exposure times.

#### H.10. Fatigue

Cumulative fatigue may develop slowly. Failure to recognize this slow development increases an individual's susceptibility to heat related problems.



# H.11. Prior heat illnesses

Prior heat illnesses lead to heat illnesses of greater severity with each incidence. There are several preventive measures:

- Water
- Salt

#### H.11.a. Water

The body needs water only in quantities sufficient to prevent dehydration and electrolyte imbalances that result from losses in sweat, urine, etc. Under conditions of profuse sweating, each person will require one pint (0.5 liters) or more of fluid intake per hour. Take water in small quantities at frequent intervals, such as every 20 or 30 minutes.

#### H.11.b. Salt

The average diet provides from 15 - 20 grams of salt daily. This amount of salt is adequate for the prevention of most heat related illnesses.